Application for Permit to Install (PTI) and Permit to Install/Operate (PTIO)

Ohio Environmental Protection Agency
Lazarus Government Center
50 West Town Street, Suite 700
P.O. Box 1049
Columbus, Ohio 43216-1049

For EPA Use Only

Application Number _____

Date Received _____

RECEIVED
FEB 20 2018
REGIONAL AIR
POLLUTION CONTROL

Facility Information

Note: Application is incomplete if all **bolded** questions throughout the application are not completed.

Legal Facility Name Dovetail Energy, LLC

Alternate Name (if any)

Facility Physical Address 1146 Herr Rd

City, ZIP code Fairborn, 45324

County Greene

Facility ID 0829005027

Facility Description

NAICS Code 221117

Facility Latitude degrees minutes seconds

Facility Longitude degrees minutes seconds

Core Place ID (if known)

SCSC ID (if known)

Portable? ☐ Yes ☐ No

Portable Type ☐ Asphalt Plant ☐ Concrete Plant ☐ Generator ☐ Aggregate Processing ☐ Concrete Crusher ☐ Grinder ☐ Other

Initial Location County If "Other", describe:

Contact Information

☐ No change to information on file.

❶ ■ Billing ■ Owner ☐ Primary ☐ Operator ☐ On-Site ☐ Responsible Official				
	Dovetail Energy, LLC	(419) 253-5300		info@renergy.com
461 State Route 61		Marengo	OH	43334

❷ ☐ Billing ☐ Owner ☐ Primary ☐ Operator ☐ On-Site ☐ Responsible Official				

❸ ☐ Billing ☐ Owner ☐ Primary ☐ Operator ☐ On-Site ☐ Responsible Official				

❹ ☐ Billing ☐ Owner ☐ Primary ☐ Operator ☐ On-Site ☐ Responsible Official				

❺ ☐ Billing ☐ Owner ☐ Primary ☐ Operator ☐ On-Site ☐ Responsible Official				

❻ ☐ Billing ☐ Owner ☐ Primary ☐ Operator ☐ On-Site ☐ Responsible Official				

Division of Air Pollution Control
Application for Permit-to-Install or Permit-to-Install and Operate

Section I – General Application Information

This section should be filled out for each permit to install (PTI) or Permit to Install and Operate (PTIO) application. A PTI is required for all air contaminant sources (emissions units) installed or modified after January 1, 1974 that are subject to OAC Chapter 3745-77. A PTIO is required for all air contaminant sources (emissions units) that are not subject to OAC Chapter 3745-77 (Title V). See the application instructions for additional information.

For OEPA use only:	☐ Installation	☐ Request Federally enforceable restrictions
	☐ Modification	☐ General Permit
	☐ Renewal	☐ Other

1. Is the purpose of this application to transition from OAC Chapter 3745-77 (Title V) to OAC Chapter 3745-31 (PTIO)?

   ☐ yes ☒ no

2. **Establish PER Due Date** - Select an annual Permit Evaluation Report (PER) due date for this facility (does not apply to facilities subject to Title V, OAC Chapter 3745-77). If the PER has previously been established and a change is now desired, a PER Change Request form must be filed instead of selecting a date here.

Due Date:	For Time Period:
☒ February 15	January 1 through December 31
☐ May 15	April 1 through March 31
☐ August 15	July 1 through June 30
☐ November 15	October 1 through September 30

   ☐ PER not applicable (Title V) or due date already established
   ☐ PER Request Permit Change form attached

3. **Federal Rules Applicability** - Please check all of the appropriate boxes below.

New Source Performance Standards (NSPS) *New Source Performance Standards are listed under 40 CFR 60 - Standards of Performance for New Stationary Sources.*	☐ not affected ☒ subject to Subpart: JJJJ ☐ unknown ☐ exempt - explain below
National Emission Standards for Hazardous Air Pollutants (NESHAP) *National Emissions Standards for Hazardous Air Pollutants are listed under 40 CFR 61. (These include asbestos, benzene, beryllium, mercury, and vinyl chloride).*	☒ not affected ☐ subject to Subpart: _____ ☐ unknown ☐ subject, but exempt - explain below
Maximum Achievable Control Technology (MACT) *The Maximum Achievable Control Technology standards are listed under 40 CFR 63 and OAC rule 3745-31-28.*	☒ not affected ☐ subject to Subpart: _____ ☐ unknown ☐ subject, but exempt - explain below
Prevention of Significant Deterioration (PSD) *These rules are found under OAC rule 3745-31-10 through OAC rule 3745-31-20.*	☒ not affected ☐ subject to regulation ☐ unknown
Non-Attainment New Source Review *These rules are found under OAC rule 3745-31-21 through OAC rule 3745-31-27.*	☒ not affected ☐ subject to regulation ☐ unknown
112 (r) - Risk Management Plan *These rules are found under 40 CFR 68.*	☒ not affected ☐ subject to regulation ☐ unknown
Title IV (Acid Rain Requirements) *These rules are found under 40 CFR 72 and 40 CFR 73.*	☒ not affected ☐ subject to regulation ☐ unknown

Please explain why you checked "exempt" in this question for one or more federal rules. Identify each exemption and whether the entire facility and/or the specific air contaminant sources included in this permit application is exempted. Attach an additional page if necessary.

4. Express PTI/PTIO - Do you qualify for express PTI or PTIO processing?

☐ yes ☒ no

If yes, are you requesting express processing per OAC rule 3745-31-05?

☐ yes ☒ no

5. **Air Contaminant Sources in this Application** - Identify the air contaminant source(s) for which you are applying below. Attach additional pages if necessary. Section II of this application and an EAC form should be completed for each air contaminant source.

Emissions Unit ID*	**Company Equipment ID** (company's name for air contaminant source)	**Equipment Description** (List all equipment that are a part of this air contaminant source)
	Digester	Digester tank with flare
	Engine	CAT 3516
	Engine	Backup generator

* This ID would have been created when a previous air permit was issued. If no previous permits have been issued for this air contaminant source, leave this field blank. If this air contaminant source was previously identified in STARShip applications as a "Z" source (e.g., Z001), please provide that identification and a new ID will be assigned when the PTI/PTIO is issued.

6. Trade Secret Information - Is any information included in this application being claimed as a trade secret per Ohio Revised Code (ORC) 3704.08?

☐ yes (A "non-confidential" version must also be submitted in order for this application to be deemed complete.)
☒ no

7. Permit Application Contact - Person to contact for questions about this application:

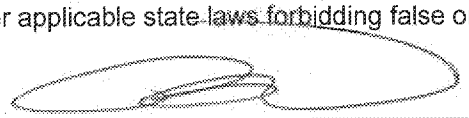
Taylor Faecher — Environmental Compliance Specialist
Name — Title

461 State Route 61 Marengo, OH 43334
Address (Street, City/Township, State and Zip Code)

(513) 476-1663 — tfaecher@renergy.com
Phone — Fax — E-mail

8. **Authorized Signature** – OAC rule 3745-31-04 states that applications for permits to install or permits to install and operate shall be signed:
   (1) In the case of a corporation, by a principal executive officer of at least the level of vice president, or his duly authorized representative, if such representative is responsible for the overall operation of the facility.
   (2) In the case of a partnership by a general partner.
   (3) In the case of sole proprietorship, by the proprietor, and
   (4) In the case of a municipal, state, federal or other governmental facility, by the principal executive officer, the ranking elected official, or other duly authorized employee.

Under OAC rule 3745-31-04, this signature shall constitute personal affirmation that all statements or assertions of fact made in the application are true and complete, comply fully with applicable state requirements, and shall subject the signatory to liability under applicable state laws forbidding false or misleading statements.



2/16/18

Authorized Signature (for facility) — Date

Alex Ringler — CEO

Print Name — Title

Section II - Specific Air Contaminant Source Information

Engine

Facility ID: _____
Emissions Unit ID: _____
Company Equipment ID: _____

One copy of this section should be filled out for each air contaminant source (emissions unit) covered by this PTI/PTIO application identified in Section I, Question 5. See the application instructions for additional information.

1. **Air Contaminant Source Installation or Modification Schedule** – Check all that apply (must be completed regardless of date of installation or modification):

☐ New installation (for which construction has not yet begun, in accordance with OAC rule 3745-31-33). When will you begin to install the air contaminant source?

(month/year) _____ **OR** after installation permit has been issued

☒ Initial application for an air contaminant source already installed or under construction. Identify installation date or the date construction began (month/year) 10/2013 and the date operation began (month/year) 10/2013

☐ Modification to an existing air contaminant source/facility (for which modification has not yet begun) - List previous PTI or PTIO number(s) for air contaminant sources included in this application, if applicable, and describe the requested modification (attach an additional sheet, if necessary):

_____

When will you begin to modify the air contaminant source? (month/year) _____ **OR** after modification permit has been issued

☐ Modification application for an air contaminant source which has been or is currently being modified. List previous PTI or PTIO number(s) for air contaminant sources included in this application, if applicable, and describe the requested modification (attach an additional sheet, if necessary):

_____

Identify modification date or the date modification began (month/year) _____ and the date operation began (month/year) _____

☐ Reconstruction of an existing air contaminant source/facility. Please explain: _____

_____

☐ Renewal of an existing permit-to-operate (PTO) or PTIO

Identify the date operation began after installation or latest modification (month/year) _____

☒ General Permit General Permit Category GP13.3 General Permit Type _____

Complete, sign and attach the appropriate Qualifying Criteria Document

☐ Other, please explain: _____

2. **SCC Codes** - List all Source Classification Code(s) (SCC) that describe the process(es) performed by this air contaminant source (e.g., 1-02-002-04).

_____ _____ _____ _____ _____

3. **Emissions Information** - The following table requests information needed to determine the applicable requirements and the compliance status of this air contaminant source with those requirements. Suggestions for how to estimate emissions may be found in the instructions to the Emissions Activity Category (EAC) forms required with this application. If you need further assistance, contact your District Office/Local Air Agency representative.
   - If total potential emissions of HAPs or any Toxic Air Contaminant (as identified in OAC rule 3745-114-01) are greater than 1 ton/yr, fill in the table for that (those) pollutant(s). For all other pollutants, if "Emissions before controls (max), lb/hr" multiplied by 24 hours/day is greater than 10 lbs/day, fill in the table for that pollutant.
   - Actual emissions are calculated including add-on control equipment. If you have no add-on control equipment, "Emissions before controls" will be the same as "Actual emissions".
   - Actual emissions and Requested Allowable should be based on operating 8760 hr/yr unless you are requesting federally enforceable operating restrictions to limit emissions. If so, calculate emissions based on requested operating restrictions and describe in your calculations.
   - If you use units other than lbs/hr or ton/yr, specify the units used (e.g., gr/dscf, lb/ton charged, lb/MMBtu, tons/12-months).
   - Requested Allowable (ton/yr) is often equivalent to Potential to Emit (PTE) as defined in OAC rule 3745-31-01 and OAC rule 3745-77-01.

Pollutant	Emissions before controls (max)* (lb/hr)	Actual emissions* (lb/hr)	Actual emissions* (ton/year)	Requested Allowable* (lb/hr)	Requested Allowable* (ton/year)
Particulate emissions (PE/PM) (formerly particulate matter, PM)					
PM 10 microns in diameter (PE/PM_{10})					
PM 2.5 microns in diameter ($PE/PM_{2.5}$)					
Sulfur dioxide (SO_2)					
Nitrogen oxides (NO_x)		3.1	14		
Carbon monoxide (CO)		14.8	6.5		
Organic compounds (OC)					
Volatile organic compounds (VOC)		3.9	17		
Lead (Pb)					
Total Hazardous Air Pollutants (HAPs)					
Highest single HAP:					
Toxic Air Contaminants (see instructions):					

* Provide your calculations as an attachment and explain how all process variables and emission factors were selected. Note the emission factor(s) employed and document origin. Example: AP-42, Table 4.4-3 (8/97); stack test, Method 5, 4/96; mass balance based on MSDS; etc.

4. **Best Available Technology (BAT)** - For each pollutant for which the Requested Allowable in the above table exceeds 10 tons per year, BAT, as defined in OAC 3745-31-01, is required. Describe what has been selected as BAT and the basis for the selection:

_____

5. **Control Equipment** - Does this air contaminant source employ emissions control equipment?

☐ Yes - fill out the applicable information below.
☒ No - proceed to Question 6.

Select the type(s) of control equipment employed below (required data for selected control equipment in **bold**):

Pollutant abbreviations

PE/PM = Particulate emissions (formerly particulate matter)
$PE/PM_{2.5}$ = PM 2.5 microns in diameter
VOC = Volatile organic compounds
NO_x = Nitrogen oxides
PE/PM_{10} = PM 10 microns in diameter
OC = Organic compounds
SO_2 = Sulfur dioxide
CO = Carbon monoxide
Pb = Lead

☐ Adsorber
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC ☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
Type: ☐ **Fluidized Bed** ☐ **Fixed Bed** ☐ **Moving Bed** ☐ **Disposable** ☐ **Concentrator** ☐ **Other** _____
Adsorption Media: _____
For Fluidized Bed, Fixed Bed, Moving Bed and Disposable only:
Maximum design outlet organic compound concentration (ppmv): _____
Media replacement frequency or regeneration cycle time (specify units): _____
Maximum temperature of the media bed, after regeneration (including any cooling cycle): _____
For Concentrator Only:
Design regeneration cycle time (minutes): _____
Minimum desorption air stream temperature (°F): _____
Rotational rate (revolutions/hour): _____
Inlet gas flow rate (acfm): _____ Outlet gas flow rate (acfm) : _____
Inlet gas temperature (°F): _____ Outlet gas temperature (°F): _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Catalytic Converter
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC ☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Catalytic Incinerator
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC ☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
Combustion chamber residence time (seconds): _____
Minimum temperature difference (°F) across catalyst during air contaminant source operation: _____
Inlet gas flow rate (acfm): _____ Outlet gas flow rate (acfm) : _____
Minimum inlet gas temperature (°F): _____ Outlet gas temperature (°F): _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel

List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Condenser
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC
☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
Type: ☐ **Indirect contact** ☐ **Direct contact** ☐ **Freeboard refrigeration device** ☐ **Other:** _____
Maximum exhaust gas temperature (°F) during air contaminant source operation: _____
Coolant type: _____
Design coolant temperature (°F): Minimum _____ Maximum _____
Design coolant flow rate (gpm): _____
Inlet gas flow rate (acfm): _____ Outlet gas flow rate (acfm) : _____
Inlet gas temperature (°F): _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Cyclone/Multiclone
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC
☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
Type: ☐ **Simple** ☐ **Multiclone** ☐ **Rotoclone** ☐ **Other** _____
Operating pressure drop range (inches of water): Minimum: _____ Maximum: _____
Inlet gas flow rate (acfm): _____ Outlet gas flow rate (acfm) : _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Dry Scrubber
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC
☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
Reagent(s) used: Type: _____ **Injection rate(s):** _____
Inlet gas flow rate (acfm): _____ Outlet gas flow rate (acfm) : _____
Inlet gas temperature (°F): _____ Outlet gas temperature (°F): _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Electrostatic Precipitator
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC

☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
Type: ☐ **Dry** ☐ **Wet** ☐ **Other:** _____
Number of operating fields: _____
Secondary voltage (V) range (minimum – maximum): _____
Secondary current (milliamps) range (minimum – maximum): _____
Inlet gas flow rate (acfm): _____ Outlet gas flow rate (acfm) : _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Fabric Filter/Baghouse
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC
☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
Operating pressure drop range (inches of water): Minimum: _____ **Maximum:** _____
Pressure type: ☐ **Negative pressure** ☐ **Positive pressure**
Fabric cleaning mechanism: ☐ Reverse air ☐ Pulse jet ☐ Shaker ☐ Other _____
Bag leak detection system: ☐ Yes ☐ No Type: _____
☐ **Lime injection or fabric coating agent used: Type:** _____ **Feed rate:** _____
Inlet gas flow rate (acfm): _____ Outlet gas flow rate (acfm) : _____
Inlet gas temperature (°F): _____ Outlet gas temperature (°F): _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Flare
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC
☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
Type: ☐ **Enclosed** ☐ **Elevated (open)**
If Elevated (open): ☐ **Air-assisted** ☐ **Steam-assisted** ☐ **Non-assisted**
Ignition device: ☐ **Electric arc** ☐ **Pilot flame**
Flame presence sensor: ☐ **Yes** ☐ **No**
Inlet gas flow rate (acfm): _____ Outlet gas flow rate (acfm) : _____
Inlet gas temperature (°F): _____ Outlet gas temperature (°F): _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Fugitive Dust Suppression
Suppressant Type: ☐ **Water** ☐ **Chemical** ☐ **Calcium chloride** ☐ **Asphaltic cement** ☐ **Other** _____
Method of application: _____
Application rate (specify units): _____
Application frequency: _____
List all egress point IDs (from Table 7-B) associated with this control strategy: _____

☐ NOx Reduction Technology
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC
☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
NOx Reduction Type: ☐ **Selective Catalytic** ☐ **Non-Selective Catalytic** ☐ **Selective Non-Catalytic**
Inlet temp.: _____ **Outlet temp.:** _____
Inlet gas flow rate (acfm): _____
For Selective types only:
Reagent type: _____
Reagent injection rate (specify units): _____
Reagent slip (acfm): _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Passive Filter
Type: ☐ **Bin vent** ☐ **Paint booth filter** ☐ **Filter sock** ☐ **Other:** _____ **Your ID for filter** _____
Design control efficiency (%): _____ Basis for efficiency: _____
Change frequency: _____
Inlet gas flow rate (acfm): _____ Outlet gas flow rate (acfm) : _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Settling Chamber
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC
☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
Length x Width x Height: _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Thermal Incinerator/Thermal Oxidizer
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC
☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
Minimum operating temp. (°F) and sensor location: _____ (See application instructions)
Combustion chamber residence time (seconds): _____
Inlet gas flow rate (acfm): _____ Outlet gas flow rate (acfm) : _____
Inlet gas temperature (°F): _____ Outlet gas temperature (°F): _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Wet Scrubber
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC
☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
Operating pressure drop range (inches of water): Minimum: _____ **Maximum:** _____
Type: ☐ **Impingement** ☐ **Packed bed** ☐ **Spray chamber** ☐ **Venturi** ☐ **Other:** _____
pH range for scrubbing liquid: Minimum: _____ Maximum: _____
Is scrubber liquid recirculated? ☐ Yes ☐ No
Scrubber liquid flow rate (gal/min): _____
Scrubber liquid supply pressure (psig): _____ NOTE: This item for spray chambers only.
Inlet gas flow rate (acfm): _____ Outlet gas flow rate (acfm) : _____
Inlet gas temperature (°F): _____ Outlet gas temperature (°F): _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

☐ Other
Type: describe _____
Manufacturer: _____ Year installed: _____ **Your ID for control equipment** _____
Describe this control equipment: _____
Pollutant(s) controlled: ☐ PE/PM ☐ PE/PM_{10} ☐ $PE/PM_{2.5}$ ☐ OC ☐ VOC
☐ SO_2 ☐ NO_x ☐ CO ☐ Pb ☐ Other _____
Estimated capture efficiency (%): _____ Basis for efficiency: _____
Design control efficiency (%): _____ Basis for efficiency: _____
Operating control efficiency (%): _____ Basis for efficiency: _____
☐ **This is the only control equipment on this air contaminant source**
If not, this control equipment is: ☐ Primary ☐ Secondary ☐ Parallel
List all other air contaminant sources that are also vented to this control equipment: _____
List all egress point IDs (from Table 7-A) associated with this control equipment: _____

6. **Process Flow Diagram** - Attach a Process Flow Diagram to this application for this air contaminant source. See the application instructions for additional information.

7. **Modeling information: (Note: items in bold in Tables 7-A and/or 7-B, as applicable, are required even if the tables do not otherwise need to be completed. If applicable, all information is required.)** An air quality modeling analysis is required for PTIs and PTIOs for new installations or modifications, as defined in OAC rule 3745-31-01, where either the increase of toxic air contaminants from any air contaminant source or the increase of any other pollutant for all air contaminant sources combined exceed a threshold listed below. This analysis is to assure that the impact from the requested project will not exceed Ohio's Acceptable Incremental Impacts for criteria pollutants and/or Maximum Allowable Ground Level Concentrations (MAGLC) for toxic air contaminants. (See Ohio EPA, DAPC's Engineering Guide #69 for more information.) Permit requests that would have unacceptable impacts cannot be approved as proposed. See the line-by-line PTI/PTIO instructions for additional information.

Complete Tables 7-A and 7-C for stack emissions egress points and/or Table 7-B and 7-C for fugitive emissions egress points below if the requested allowable annual emission rate for this PTI or PTIO exceeds any of the following:

- Particulate Emissions (PE/PM_{10}): 10 tons per year
- Sulfur Dioxide (SO2): 25 tons per year
- Nitrogen Oxides (NOx): 25 tons per year
- Carbon Monoxide (CO): 100 tons per year
- Lead (Pb): 0.6 ton per year
- Toxic Air Contaminants: 1 ton per year. Toxic air contaminants are identified in OAC rule 3745-114-01.

Complete Table 7-A below for each stack emissions egress point. An egress point is a point at which emissions from an air contaminant source are released into the ambient (outside) air. List each individual egress point on a separate pair of lines. In each case, use the dimensions of the tallest nearby (or attached) building, building segment or structure.

Table 7-A, Stack Egress Point Information

❶ Company ID for the Egress Point	Type Code*	Dimensions or Diameter	Height from the Ground (ft)	Temp. at Max. Operation (F)	Flow Rate at Max. Operation (ACFM)	Minimum Distance to Fence Line (ft)
Company Description for the Egress Point	Shape: round, square, rectangular	Cross Sectional Area	Base Elevation (ft)	Building Height (ft)	Building Width (ft)	Building Length (ft)

❷ Company ID for the Egress Point	Type Code*	Dimensions or Diameter	Height from the Ground (ft)	Temp. at Max. Operation (F)	Flow Rate at Max. Operation (ACFM)	Minimum Distance to Fence Line (ft)
Company Description for the Egress Point	Shape: round, square, rectangular	Cross Sectional Area	Base Elevation (ft)	Building Height (ft)	Building Width (ft)	Building Length (ft)

❸ Company ID for the Egress Point	Type Code*	Dimensions or Diameter	Height from the Ground (ft)	Temp. at Max. Operation (F)	Flow Rate at Max. Operation (ACFM)	Minimum Distance to Fence Line (ft)
Company Description for the Egress Point	Shape: round, square, rectangular	Cross Sectional Area	Base Elevation (ft)	Building Height (ft)	Building Width (ft)	Building Length (ft)

❹ Company ID for the Egress Point	Type Code*	Dimensions or Diameter	Height from the Ground (ft)	Temp. at Max. Operation (F)	Flow Rate at Max. Operation (ACFM)	Minimum Distance to Fence Line (ft)
Company Description for the Egress Point	Shape: round, square, rectangular	Cross Sectional Area	Base Elevation (ft)	Building Height (ft)	Building Width (ft)	Building Length (ft)

*Type codes for stack egress points:

A. vertical stack (unobstructed): There are no obstructions to upward flow in or on the stack such as a rain cap.
B. vertical stack (obstructed): There are obstructions to the upward flow, such as a rain cap, which prevents or inhibits the air flow in a vertical direction.
C. non-vertical stack: The stack directs the air flow in a direction which is not directly upward.

Complete Table 7-B below for each fugitive emissions egress point. List each individual egress point on a separate line. Refer to the description of the fugitive egress point types below the table for use in completing the type column of the table. For an air contaminant source with multiple fugitive emissions egress points, include only the primary egress points.

Table 7-B, Fugitive Egress Point Information

❶ Company ID or Name for the Egress Point	Type* (check one) ☐ Area ☐ Volume	Area Source Dimensions (Length x Width, in feet)	Volume Source Dimensions (Height x Width, in feet)
Company Description for the Egress Point	Release Height (ft)	Exit Gas Temp. (only if in excess of 100° F) (°F)	Minimum Distance to the Fence Line (ft)

❷ Company ID or Name for the Egress Point	Type* (check one) ☐ Area ☐ Volume	Area Source Dimensions (Length x Width, in feet)	Volume Source Dimensions (Height x Width, in feet)
Company Description for the Egress Point	Release Height (ft)	Exit Gas Temp. (only if in excess of 100° F) (°F)	Minimum Distance to the Fence Line (ft)

❸ Company ID or Name for the Egress Point	Type* (check one) ☐ Area ☐ Volume	Area Source Dimensions (Length x Width, in feet)	Volume Source Dimensions (Height x Width, in feet)
Company Description for the Egress Point	Release Height (ft)	Exit Gas Temp. (only if in excess of 100° F) (°F)	Minimum Distance to the Fence Line (ft)

*Types for fugitive egress point:

Area: an open fugitive source characterized as a horizontal area (L x W) with a release height. For irregular surfaces such as storage piles, enter dimensions of an average cross section; release height is entered as half of the maximum pile height. For process sources such as crushers, use the process opening (e.g., area of crusher hopper opening) and ignore material handling and storage emissions points.

Volume: an unpowered vertical opening, such as a window or roof monitor, characterized as a vertical area (W x H) with a release height, measured at the midpoint of the opening. Multiple openings in a building may be averaged, if necessary.

Use the same Company Name or ID for the Egress Point in Table 7-C that was used in Table 7-A or 7-B. See the line-by-line PTI/PTIO instructions for additional information.

Table 7-C, Egress Point Location

Company Name or ID for the Egress Point (as identified above)	Egress Point Latitude			Egress Point Longitude		
	deg	min	sec	deg	min	sec
	deg	min	sec	deg	min	sec
	deg	min	sec	deg	min	sec
	deg	min	sec	deg	min	sec
	deg	min	sec	deg	min	sec

8. Request for Enforceable Restrictions - As part of this permit application, do you wish to propose voluntary restrictions to limit emissions in order to avoid specific requirements listed below, (i.e., are you requesting state-only enforceable limits or state and federally enforceable limits to obtain synthetic minor status)?

☐ yes
☐ no
☒ not sure - please contact me to discuss whether this affects the facility.

If yes, why are you requesting enforceable restrictions? Check all that apply.

☐ a. to avoid being a major Title V source (see OAC rule 3745-77-01 and OAC rule 3745-31)
☐ b. to avoid being a major MACT source (see OAC rule 3745-31-01)
☐ c. to avoid being a major stationary source (see OAC rule 3745-31-01)
☐ d. to avoid being a major modification (see OAC rule 3745-31-01)
☐ e. to avoid an air dispersion modeling requirement (see Engineering Guide # 69)
☐ f. to avoid BAT requirements (see OAC rule 3745-31-05(A)(3)(b))
☐ g. to avoid another requirement. Describe: _____

If you checked a., b. or c., please attach a facility-wide potential to emit (PTE) analysis (for each pollutant) and synthetic minor strategy to this application. (See application instructions for definition of PTE.) If you checked d., please attach a net emission change analysis to this application. If you checked e., f. or g., please attach a description of the restrictions proposed and how compliance with those restrictions will be verified.

9. Continuous Emissions Monitoring – Does this air contaminant source utilize any continuous emissions monitoring (CEM) equipment for indicating or demonstrating compliance? This does not include continuous parametric monitoring systems.

☐ yes ☒ no

If yes, complete the following information.

Company Name or ID for the Egress Point _____

CEM Description _____

This CEM monitors (check all that apply):

Opacity Flow CO NOx SO_2 THC HCl HF H_2S TRS CO_2 O_2 PM

10. **EAC Forms** - The appropriate Emissions Activity Category (EAC) form(s) must be completed and attached for each air contaminant source unless a general permit is being requested. At least one complete EAC form must be submitted for each air contaminant source for the application to be considered complete. Refer to the list attached to the application instructions. Please indicate which EAC form corresponds to this air contaminant source.

3101

FOR OHIO EPA USE
FACILITY ID: _____
EU ID: _____ Application #: _____

EMISSIONS ACTIVITY CATEGORY FORM
INTERNAL COMBUSTION ENGINES OR TURBINES

This form is to be completed for each reciprocating engines or turbines. State/Federal regulations which may apply to internal combustion engines are listed in the instructions. Note that there may be other regulations which apply to this emissions unit which are not included in this list.

1. Maximum Operating Schedule: 24 hours per day; 365 days per year

   If the schedule is less than 24 hours/day or 365 days/year, what limits the schedule to less than maximum? See instructions for examples. Service Intervals, Engine Availability

2. Engine type: ☐ Turbine ☑ Reciprocating

3. Purpose of engine: ☐ Driving pump or compressor ☑ Driving electrical generator

4. Normal use of engine: ☐ Emergency only ☑ Non-emergency

5. Engine Manufacturer: Caterpillar Model No: 3516

   Model Year: 2008 Serial Number: MJ02573JJ03

   Date engine was ordered from the manufacturer: 10/1/2012

   Date engine was first installed at any location by any operator/facility: 10/25/2013

   Has the manufacturer certified the engine to meet any emissions standards? ☐No ☐Yes

   If yes, which Part and paragraph and/or Table and/or Tier has been met? _____

   Will the engine be operated under the conditions the manufacturer has identified as necessary to meet these standards? ☐No ☑Yes

6. Type of ignition: ☐ compression (diesel) ☑ spark

7. Displacement (for reciprocating engines only):

   _____(Liters/cylinder, for compression ignition)

   _____(cubic centimeters, for spark ignition)

8. Engine exhaust configuration (for turbines only):
   - ☐ simple cycle *(no heat recovery)*
   - ☐ regenerative cycle *(heat recovery to preheat combustion air)*
   - ☐ cogeneration cycle *(heat recovered to produce steam)*
   - ☐ combined cycle *(heat recovered to produce steam which drives generator)*

9. Input capacities (million BTU/hr): Rated: 9.78 Maximum 9.78 Normal _____

Supplemental burner (duct burner) input capacity, if equipped (million BTU/hr):

Rated: _____ Maximum _____ Normal _____

10. Output capacities (Horsepower): Rated: 1341 Maximum 1341 Normal 1150

(Kilowatts): Rated: 1,000 Maximum 1,000 Normal 925

(lbs steam/hr)*: Rated: _____ Maximum _____ Normal _____

**(for cogeneration or combined cycle units only)*

11. Type of fuel fired (check all that apply):

- ☐ single fuel
- ☐ dual fuel
- ☐ gasoline
- ☐ No. 2 oil, low-sulfur
- ☐ No. 2 oil, high-sulfur
- ☐ propane
- ☐ natural gas
- ☐ diesel
- ☐ other, explain _____
- ☐ landfill gas
- ☒ digester gas

12. Complete the following table for all fuels identified in question 11 that are used for the engine and any supplemental (duct) burners, if equipped:

Fuel	Heat Content (BTU/unit)	wt.% Ash	wt.% Sulfur	Fuel Usage: Estimated Maximum Per Year	Fuel Usage: Normal Per Hour	Fuel Usage: Max. Per Hour
Nat. gas	BTU/cu ft		gr/scf	cu ft	cu ft	cu ft
No. 2 oil	BTU/gal			gal	gal	gal
Gasoline	BTU/gal			gal	gal	gal
Diesel	BTU/gal			gal	gal	gal
Landfill/digester gas	550 BTU/cu ft		ppm	55,577,600 cu ft	17,760 cu ft	17,760 cu ft
Other (show units)						
List supplemental (duct) burner fuel and information below (show units):						

13. Type of combustion cycle (check all that apply):

- ☐ 2-stroke
- ☒ 4-stroke
- ☐ carbureted
- ☐ rich-burn
- ☐ lean-burn
- ☐ fuel injected
- ☐ other, explain _____

14. Emissions control techniques (check all that apply):

- ☐ prestratified charge
- ☐ air/fuel ratio
- ☐ catalytic oxidation
- ☐ preignition chamber combustion (PCC)
- ☐ nonselective catalytic reduction (NSCR)
- ☐ selective catalytic reduction (SCR)
- ☐ 2-stage rich/lean combustion
- ☐ water/steam injection
- ☐ injection timing retard
- ☐ 2-stage lean/lean combustion
- ☐ diesel particulate filter
- ☐ other, explain _____

For each emissions control technique checked above, explain what pollutants are controlled by each technique: _____

15. Has the engine been modified or reconstructed since its manufacture date: ☐ No ☒ Yes
If Yes, explain:
Modified to support combustion with biogas

NOTES:
MAIN HYDRAULIC FLOW PATH SHOWN. REFER TO P&ID DRAWINGS FOR ADDITIONAL PIPING DETAILS.
BIOGAS HANDLING COMPONENTS NOT SHOWN.
GLYCOL HOT WATER HEATING LOOPS NOT SHOWN

EXISTING EQUIPMENT

T-003 & T-004 EXISTING LIQUIDS RECEIVING TANK(S)

100

T-001 BIOMASS RECEIVING TANK 230 kGAL

120

P-002 EXISTING FEED PUMP

G-001 EXISTING MACERATOR

110

H-001 SOLIDS RECEIVING HOPPER WITH PUMP P-001 & GRINDER G-002

A-001B AGITATOR (NEW EQUIPMENT)

E-090B FINAL COOLING HEAT EXCHANGER

E-080A HEAT RECOVERY HEAT EXCHANGER

E-080B HEAT EXCHANGER

E-080C HEAT EXCHANGER

T-090A PFRP PLUG FLOW HOLDING TANK 2,000 GAL (26 MINUTES)

T-090B PFRP PLUG FLOW HOLDING TANK 2,000 GAL (26 MINUTES)

A-100 AGITATOR

T-100 BIOMASS HOLDING TANK 230 kGAL

94.5°F

160°F

E-090A COOLING HEAT RECOVERY HEAT EXCHANGER

75 GPM 50°F

160°F TEMP IN

160°F TEMP OUT

130

140

115°F

VS_{IN} SAMPLE STATION

P-080A PFRP PUMP

P-080B PFRP PUMP

STARTUP RECYCLE BYPASS IF PFRP PLUG FLOW TANKS < 160°F

4x SIDE ENTRY MIXERS

T-002 DIGESTER 750 kGAL

MESOPHILIC 100 °F

160

AGITATOR

T-101 DIGESTER 1.722 MGAL

MESOPHILIC 100 °F

150

P-095 NEW DOSING PUMP

REV 11/3/2017

180

T-008 EXISTING EFFLUENT STORAGE TANK 5M GAL

E-001 EXISTING HEAT EXCHANGER HEATING OR COOLING

P-003 EXISTING HEATING, DOSING & EFFLUENT PUMP (REPURPOSED TO EFFLUENT ONLY)

EQ & VS_{OUT} SAMPLE STATION

TO LAND APPLICATION

	Liquid Receiving	Solids Receiving	Primary Feedstock Tank	Heat treatment	Secondary Feedstock Tank	1.1 MGAL Digester	750 KGAL Digester	Total Digester	Effluent
	100	110	120	130	140	150	160	170	180
STORAGE VOL. (CY)		21							
STORAGE VOL. (GAL)	24,000		730,000	5,000	730,000	1,050,000	750,000	1,800,000	6,000,000
TONS PER YEAR	109,573	84,750	164,323	164,323	164,323	65,855	65,468	164,323	164,323
TONS PER DAY,	300	150	450	450	450	263	183	450	
GALLONS PER YEAR	26,276,499	15,129,496	39,405,995	39,405,995	39,405,995	22,986,891	16,419,165	39,405,995	39,405,995
GALLONS PER DAY,	71,990	35,971	107,962	107,962	107,962	62,978	44,984	107,962	107,962
GALLONS PER Minute			75	75	75	44	31	75	75
HRT (minutes)				40					
HRT (days)			2.130		2.130	16.7	16.7	16.7	46.3
Temperature (F)	50	50	50	160	115	100	100	100	
TOTAL SOLIDS (%)	8.5%	20.0%	10.1%	10%	15%	8%	8%	8%	8%

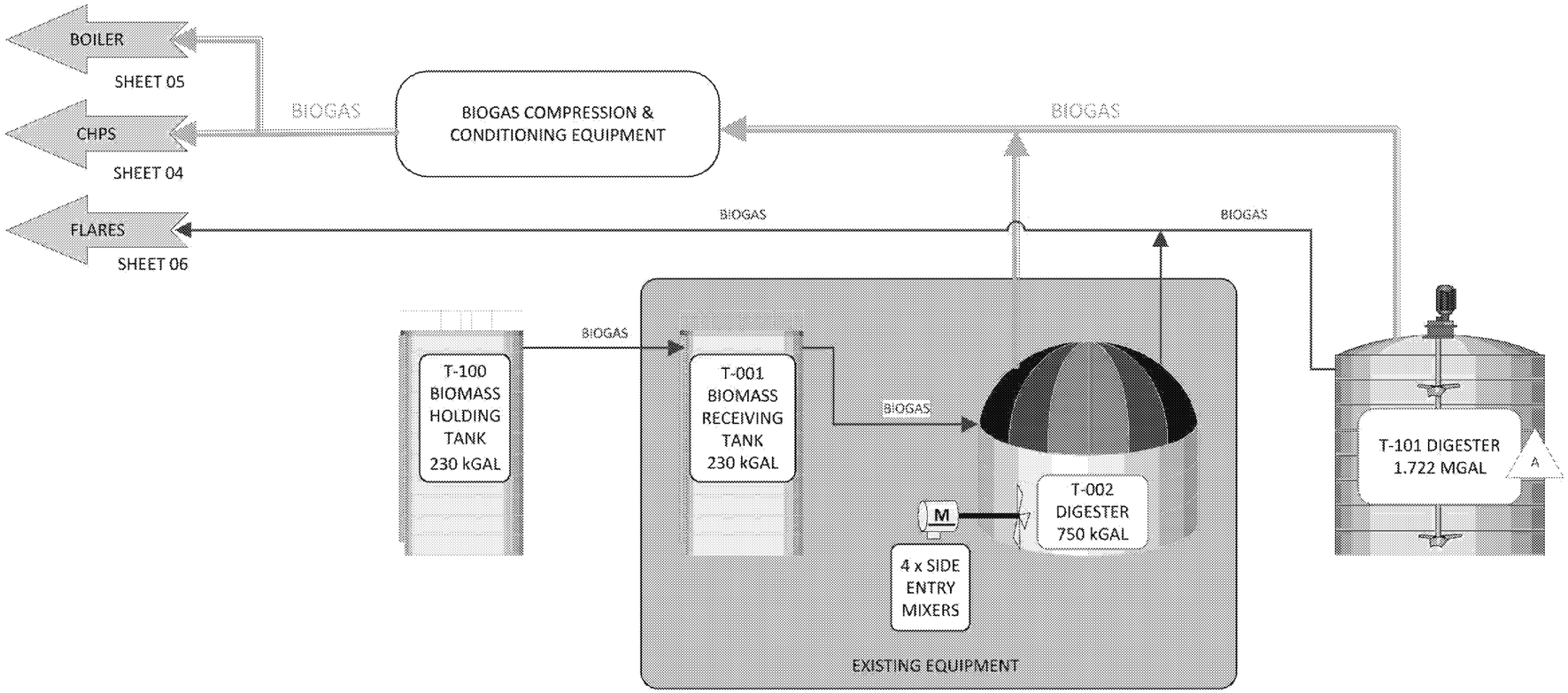
NO.	DATE
C	10/31/2017
BY: BR	
REVISION: MOVED EQ SAMPLE STATION NOTE TO POST-DIGESTION, RELOC. SAMPLE PORT PRIOR TO E-001 (EXISTING PHYS. LOC), REM. BYPASS AROUND E-001	
NO. B	DATE 10/12/2017
BY: BR	
REVISION: T-090A & T-090B TO 2,000 GALLONS FROM 3,000. ADDED SAMPLE STATION LOCATIONS. CORRECTED P-003 MANIFOLD	
NO. A	DATE 09/08/2017
BY: BR	
REVISION: UPDATED WITH ALL HEAT EXCHANGER UNITS SHOWN	

GREEN ARROW

1680 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
HYDRAULIC OVERVIEW
& MASS BALANCE

AREA	CHECKED BY: CH
JOB NO.: 1602	DRAWN BY: NM
SCALE: N.T.S.	DATE: 07/05/2017
DWG NO.: 0001-001	
SHEET NO.: 01	



NO.	DATE
BY	
REVISION	

NO.	DATE
B	11/03/2017
BY	CY
REVISION	INCREASED T-101 VOLUME

NO.	DATE
A	09/08/2017
BY	BR
REVISION	ADDED BIOGAS COMPRESSION/ CONDITIONING EQ., BOILER CONNECTION

GREEN ARROW
1680 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
BIOGAS COLLECTION

AREA	CHECKED BY
	CH
JOB NO.	DRAWN BY
1602	NM
SCALE	DATE
N.T.S.	07/05/2017

DWG NO.
0001-001

SHEET NO.
02

HOT WATER RETURN

HW LOOP

HOT WATER SUPPLY

BOILER(S)

5 PSIG PROPANE/
NATURAL GAS

3 PSIG BIOGAS

SHEET 02

EXHAUST

CATALYST

3.5 MMBTU/HR

16
CYLINDER

1000 KW

EXISTING
CHP

CIRCULATOR
PUMP

EXHAUST

CATALYST

3.5 MMBTU/HR

16
CYLINDER

1000 KW

NEW
CHP-351

480VAC

CIRCULATOR
PUMP

NO.	DATE
BY	
REVISION	

NO.	DATE
BY	
REVISION	

NO.	DATE
A	09/08/2017
BY	
BR	
REVISION	
SEPARATED BIOGAS & NG/ PROPANE TRAINS	

GREEN ARROW

1680 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
COMBINED HEAT & POWER
GENERATORS

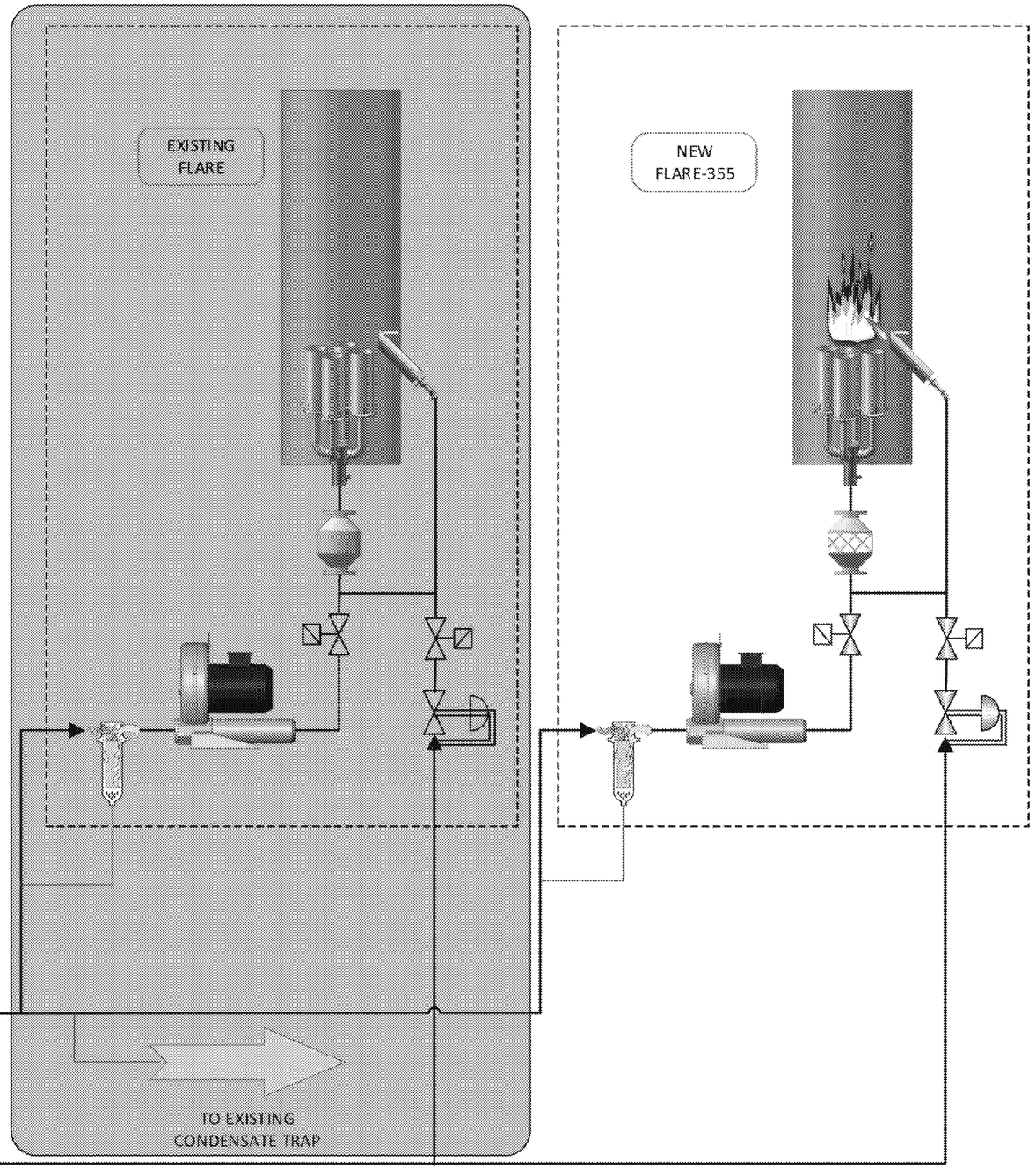
AREA	CHECKED BY
	CH
JOB NO.	DRAWN BY
1602	NM
SCALE	DATE
N.T.S.	03/13/2017

DWG NO.

0430-001

SHEET NO.

03



PROPANE OR NATURAL GAS USED FOR CONTINUOUS PILOT OPERATION ONLY IF BIOGAS < 450 BTU/SCF

NO.	DATE
BY	
REVISION	

NO.	DATE
BY	
REVISION	

NO.	DATE
A	09/08/2017
BY	BR
REVISION	ADDED DRAIN TO EXISTING CONDENSATE TRAP CONNECTOR

GREEN ARROW

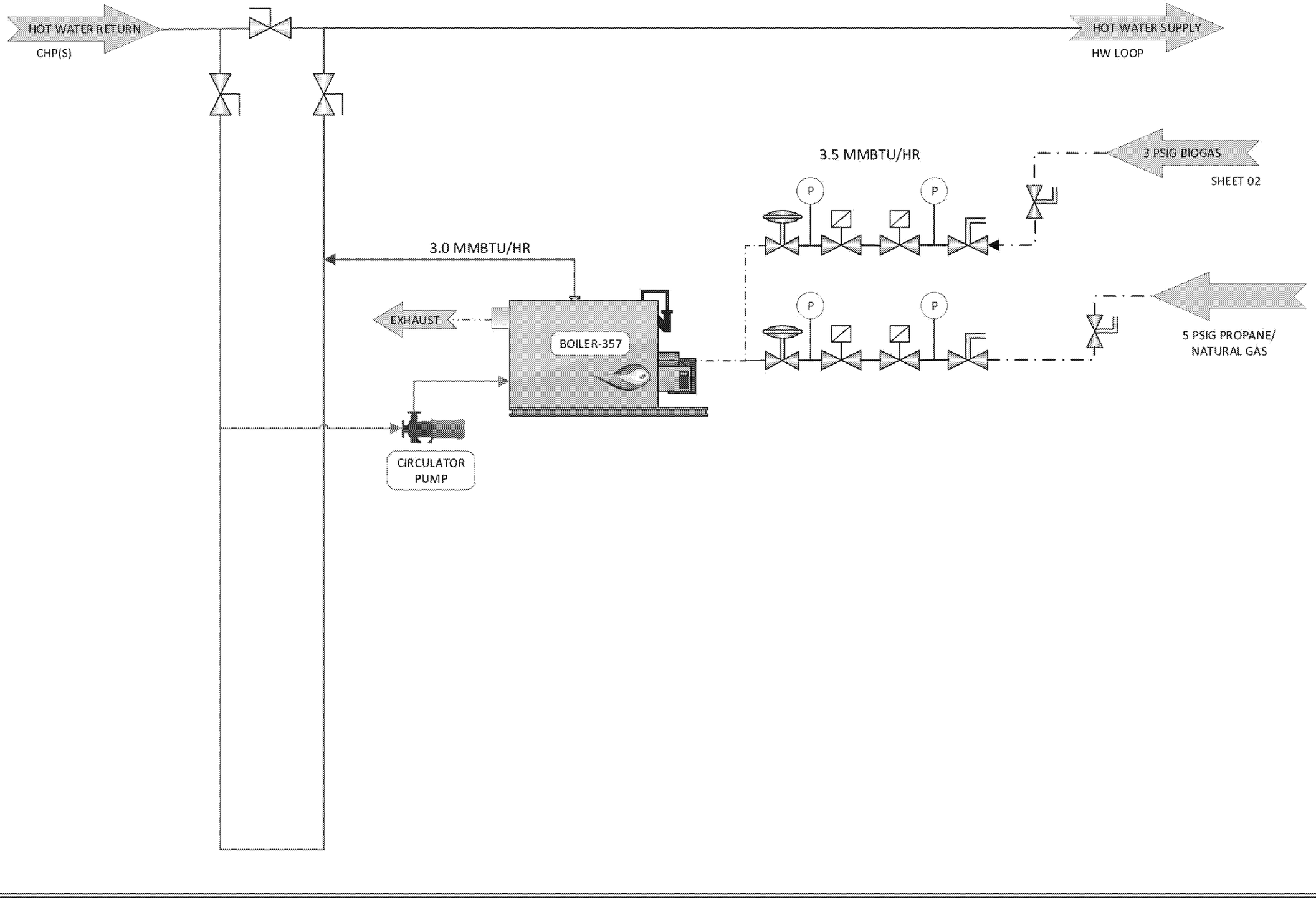
1680 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
BIOGAS FLARES

AREA	CHECKED BY
	CH
JOB NO.	DRAWN BY
1602	NM
SCALE	DATE
N.T.S.	03/13/2017

DWG NO.
0440-001

SHEET NO.
04



NO.	DATE
BY	
REVISION	

NO.	DATE
BY	
REVISION	

NO.	DATE
A	09/08/2017
BY	
BR	
REVISION	
ADDED BIOGAS SHEET TAG	

GREEN ARROW

1680 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
BIOGAS BOILER

AREA	CHECKED BY
	CH
JOB NO.	DRAWN BY
1602	NM
SCALE	DATE
N.T.S.	03/13/2017

DWG NO.
0450-001

SHEET NO.
05

Boiler Water Flow Rate		
Heat Output	3,000,000	BTU/hr
Outlet Temp	190	F
Delta Temp	30	F
Flow Rate	200	GPM
Water Pipe Size	3	inch
System Pressure	30	PSI
Boiler Rating	50	PSI

Heating Fluid	50% Ethylene Glycol

Combustion		
Min. Burner Turndown	3:1	
Combustion Efficiency	82%	Percent
Input Energy	3,680,000	BTU/HR
Biogas HHV	600	BTU/CF
Biogas Flow Rate	6,133	SCFH
	102	SCFM
Gas Train Pipe Size	2.5	inch
Combustion Air Req. 25% excess Air	829	SCFM
Flue Gas Temp	450	F
Biogas Manifold Pressure	8-14	inWC
Burner Motor HP	3	HP

UL GAS TRAIN COMPONENTS

	KromSchroder	Dungs	Honeywell
VALVE	VCS 665	DMV 5065	V5097A1012/U
Size	2.5" Flanged	2.5" Flanged	2.5" Threaded
Type	Solenoid	Solenoid	

	Sensus	Maxitrol	Fisher
REGULATOR	122 / GRN	RV 91 / GRN	66 / BLK ST

NO.	DATE
BY	
REVISION	

NO.	DATE
BY	
REVISION	

NO.	DATE
A	09/08/2017
BY	
BR	
REVISION	
UPDATED DRAWING DESCRIPTION	

GREEN ARROW

1680 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
BIOGAS BOILER
BASIC SPECS

AREA	CHECKED BY
	CH
JOB NO.	DRAWN BY
1602	NM
SCALE	DATE
N.T.S.	03/13/2017

DWG NO.
0450-002

SHEET NO.
06

CHP(S)

HOT WATER RETURN

SHEET 08

HOT WATER RETURN

EXISTING EQUIPMENT

AIR SEPARATOR

HOT WATER SUPPLY

BOILER(S)

P-005A EXISTING HOT WATER LOOP PUMP

P-005B NEW HOT WATER LOOP PUMP

BALANCING VALVE

HOT WATER SUPPLY

SHEET 08

EXPANSION TANK

SYSTEM FEEDER

NO.	DATE
BY	
REVISION	

NO.	DATE
BY	
REVISION	

NO.	DATE
A	09/08/17
BY	BR
REVISION	UPDATED SHEET TAGS

GREEN ARROW

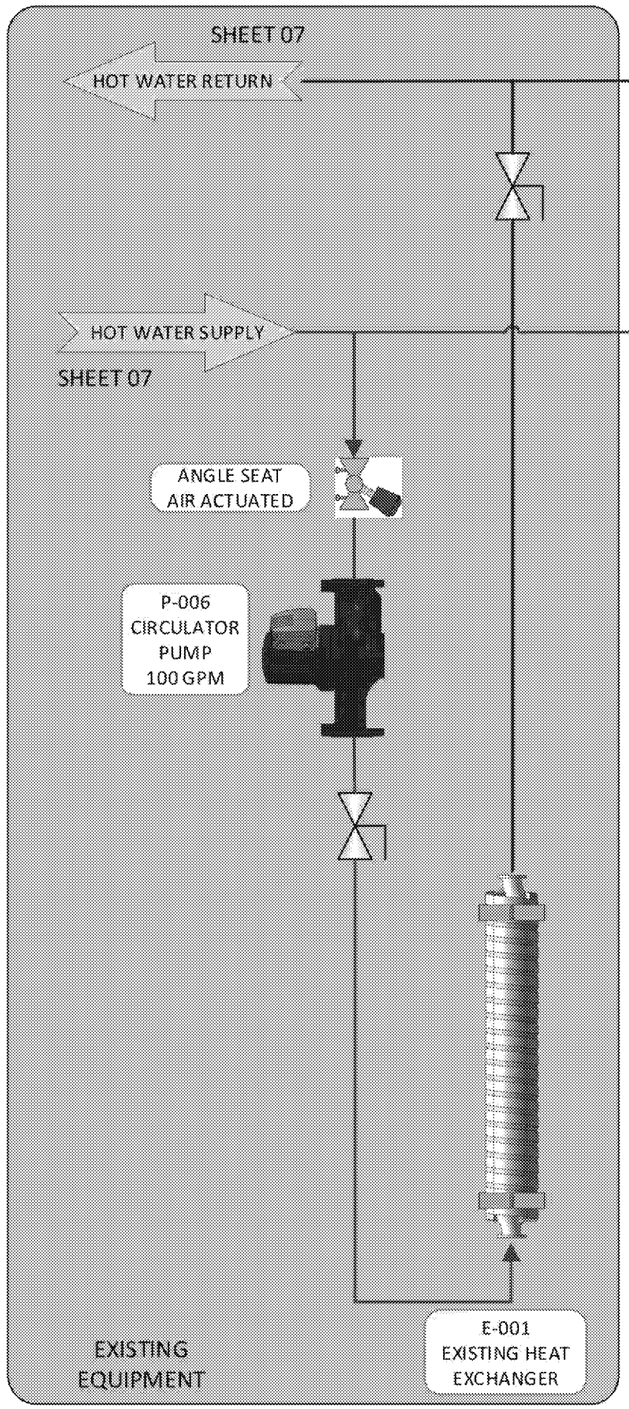
1680 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
PLANT HOT WATER
PRIMARY LOOP PUMPS

AREA	CHECKED BY
	CH
JOB NO.	DRAWN BY
1602	NM
SCALE	DATE
N.T.S.	04/14/2017

DWG NO.
0610-001

SHEET NO.
07



SHEET 09
HOT WATER RETURN

HOT WATER SUPPLY
SHEET 09

NO.	DATE
BY	
REVISION	

NO.	DATE
BY	
REVISION	

NO.	DATE
A	09/08/2017
BY	
BR	
REVISION	
UPDATED SHEET TAGS	

GREEN ARROW

1680 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
PLANT HOT WATER
PROCESS LOOPS

AREA	CHECKED BY
	CH
JOB NO.	DRAWN BY
1602	NM
SCALE	DATE
N.T.S.	04/14/2017

DWG NO.
0610-003

SHEET NO.
08

SHEET 08

HOT WATER RETURN

SHEET 10

HOT WATER RETURN

HOT WATER SUPPLY

SHEET 08

HOT WATER SUPPLY

SHEET 10

ANGLE SEAT AIR ACTUATED (TYPICAL)

CIRCULATOR PUMP 100 GPM (TYPICAL)

FROM E-090C FINAL COOLING RADIATOR SHEET 12

TO E-090C FINAL COOLING RADIATOR SHEET 12

E-090B FINAL COOLING HEAT EXCHANGER

E-090A COOLING HEAT RECOVERY HEAT EXCHANGER

CIRCULATOR PUMP 200 GPM

E-080A HEAT RECOVERY HEAT EXCHANGER

E-080B HEAT EXCHANGER

E-080C HEAT EXCHANGER

T-090A JACKETED HOLDING TANK

T-090B JACKETED HOLDING TANK

NOTE:
HEAT EXCHANGER SLUDGE PIPING NOT SHOWN FOR CLARITY,
SEE SHEET 01 FOR PLANT SLUDGE HYDRAULIC OVERVIEW PIPING

NO.	DATE
BY	
REVISION	
NO.	DATE
BY	
REVISION	
NO. A	DATE 09/08/2017
BY BR	
REVISION UPDATED SHEET TAGS, REMOVED SLUDGE PIPING FOR CLARITY	

GREEN ARROW

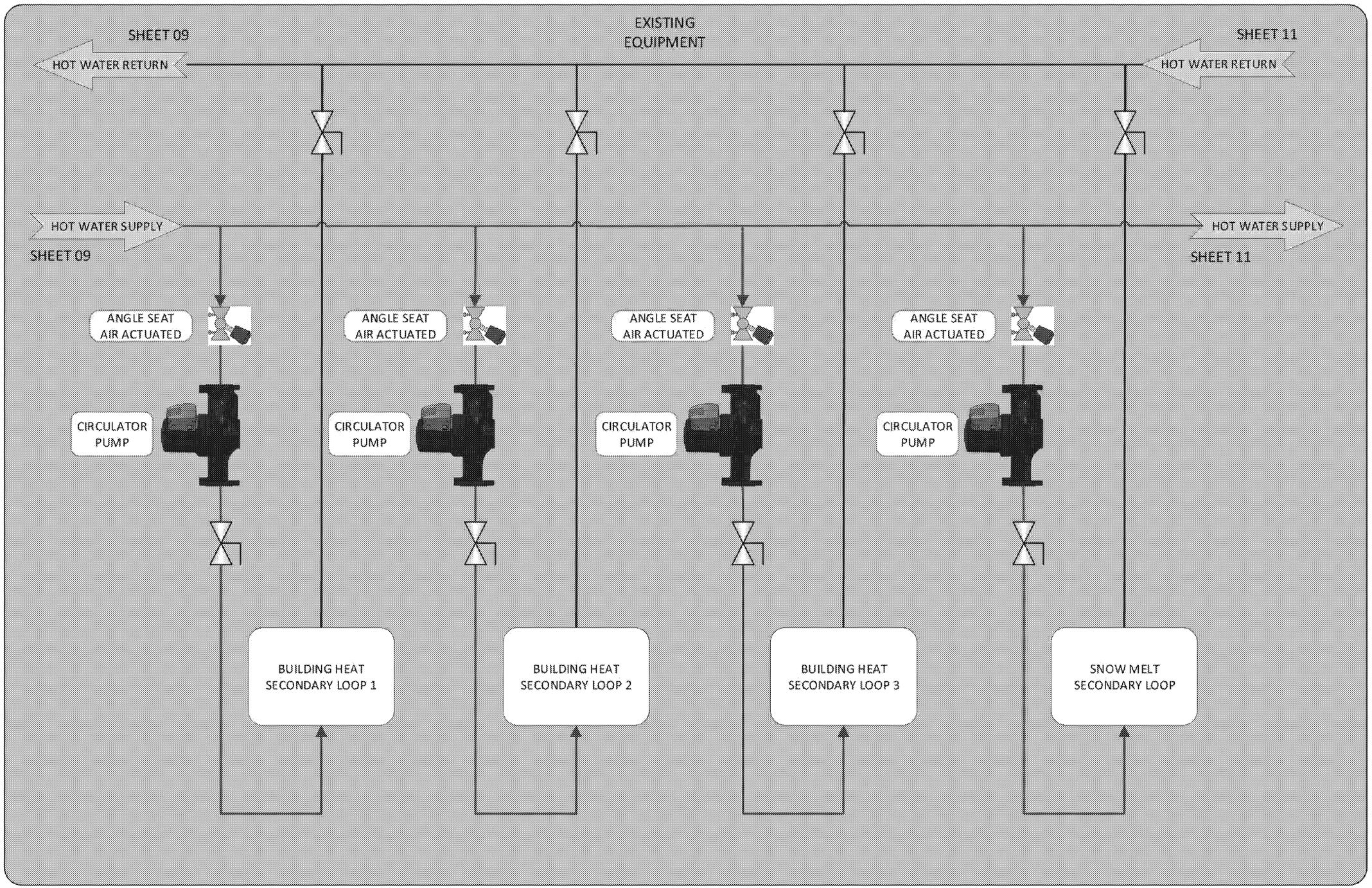
1680 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
PLANT HOT WATER
PROCESS LOOPS

AREA	CHECKED BY CH
JOB NO. 1602	DRAWN BY NM
SCALE N.T.S.	DATE 04/14/2017

DWG NO. 0610-003

SHEET NO. 09



NO.	DATE
BY	
REVISION	

NO.	DATE
BY	
REVISION	

NO.	DATE
A	09/08/2017
BY	
BR	
REVISION	
UPDATED SHEET TAGS	

GREEN ARROW

1660 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
PLANT HOT WATER
PROCESS LOOPS

AREA	CHECKED BY
	CH
JOB NO.	DRAWN BY
1602	NM
SCALE	DATE
N.T.S.	04/14/2017

DWG NO.
0610-004

SHEET NO.
10

SHEET 10

HOT WATER RETURN

HOT WATER SUPPLY

SHEET 10

ANGLE SEAT AIR ACTUATED

CIRCULATOR PUMP

PFRP BUILDING HEAT SECONDARY LOOP 1

ANGLE SEAT AIR ACTUATED

CIRCULATOR PUMP

PFRP BUILDING HEAT SECONDARY LOOP 2

ANGLE SEAT AIR ACTUATED

CIRCULATOR PUMP

PFRP BUILDING HEAT SECONDARY LOOP 3

ANGLE SEAT AIR ACTUATED

CIRCULATOR PUMP

PFRP SNOW MELT SECONDARY LOOP

NO.	DATE
BY	
REVISION	
NO.	DATE
BY	
REVISION	
NO. A	DATE 09/08/2017
BY BR	
REVISION UPDATED SHEET TAGS	

GREEN ARROW

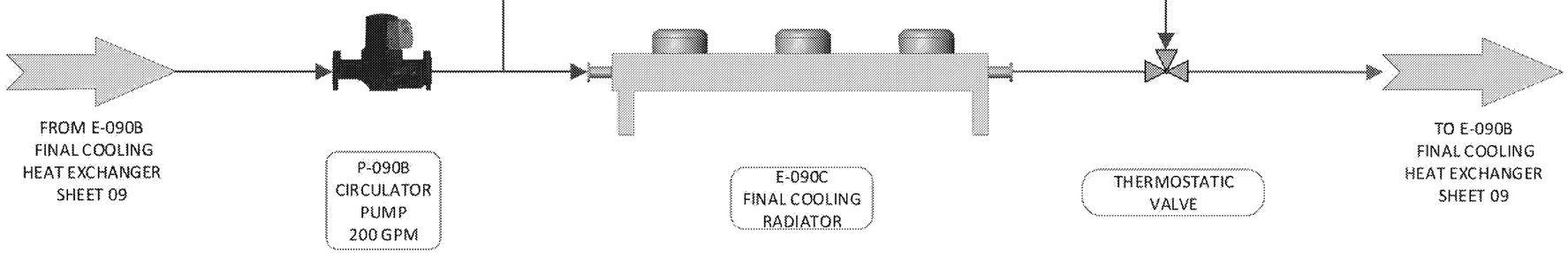
1680 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
PLANT HOT WATER
PROCESS LOOPS

AREA	CHECKED BY CH
JOB NO. 1602	DRAWN BY NM
SCALE N.T.S.	DATE 04/14/2017

DWG NO.
0610-005

SHEET NO.
11



NO.	DATE
BY	
REVISION	

NO.	DATE
BY	
REVISION	

NO.	DATE
A	09/08/2017
BY	
BR	
REVISION	
UPDATED SHEET TAGS	

GREEN ARROW

1680 MADISON AVENUE
WOOSTER, OH 44691

RENERGY
DOVETAIL EXPANSION
PLANT HOT WATER
PROCESS LOOPS

AREA	CHECKED BY
	CH
JOB NO.	DRAWN BY
1602	NM
SCALE	DATE
N.T.S.	04/14/2017

DWG NO.
0610-006

SHEET NO.
12

Model General Permit (MGP) Qualifying Criteria Document

Source Description: A stationary spark ignition internal combustion engine (SI ICE) greater than 1,040 hp and less than 2,800 hp (gross output)

MGP Number: GP13.3

Qualifying Criteria:

Answer the following questions by checking the appropriate box for the choice that describes the equipment for which you are applying for a permit. Then review the qualifying criteria described after the list.

☑ Yes	☐ No	1. Was the stationary spark ignition internal combustion engine manufactured on or after June 12, 2006?
☑ Yes	☐ No	2. Is the SI ICE rated between 1,040 hp and 2,800 hp (gross output) with a maximum heat input of 16.9 mmBtu/hour?
☑ Yes	☐ No	3...Does the owner or operator agree to an operational limitation of 1000 ppm_v of hydrogen sulfide in digester gas?
☑ Yes	☐ No	4. Will the SI ICE combust only natural gas and/or digester gas with a minimum heat content of 500 Btu/scf?
☑ Yes	☐ No	5. Will the stack height be at least 18 feet, measured from the ground, and at least 150 feet from the property line?
☑ Yes	☐ No	6. Is the potential to emit (PTE) for the facility less than 100 tons per year of carbon monoxide (CO)?
☑ Yes	☐ No	7. Does the owner or operator agree that the emissions unit covered by this general permit can remain in compliance with all of the terms and conditions of the general permit, including compliance with the applicable requirements from 40 CFR Part 60, Subpart JJJJ?
☑ Yes	☐ No	8. Was the unit installed on or after August 3, 2006?
☐ Yes	☐ No	9. Does the owner or operator have sufficient data to show that the emission factors provided adequately demonstrate compliance with the emission limitations? If you are unsure, check with the appropriate Ohio EPA District Office or local air agency.

need stack test data from last tuning. Engine Manufacturer Specification

☐ Yes	☒ No	10. Is the air contaminant source(s) for which this general permit is being sought a part of a new major stationary source or major modification (see OAC 3745-31-01)? If you are unsure, check with the appropriate Ohio EPA District Office or local air agency.

existing

If the answers to questions 1 through 9 is yes and the answer to question 10 is no, the stationary spark ignition internal combustion engine (SI ICE) meets the above "Qualifying Criteria." Otherwise, the SI ICE is not eligible for a general permit and will, instead, need a standard, or traditional permit. By signing below, the owner or operator's signature shall constitute personal affirmation that the applicant meets the qualifying criteria contained above, and shall subject the signatory to liability under applicable state laws forbidding false or misleading statements.

Ned Mast 2-13-18

Authorized Signature (for facility) Date

Owners engineer for Renergy

Title

Green Arrow Engineering
1680 Madison Ave
Wooster 44691

Primary Regulated Emission Sources (combustion of Biogas)

		Constituent			
Device	**Units**	**NOx**	**CO**	**VOC**	
CHP	tons/yr	13.6	65.0	17.2	

Intermittent Sources based on limited operation

		Constituent				
Device	**Units**	**NOx**	**CO**	**VOC**	**SOx**	**SCF/yr**
Biogas Flares	tons/yr	3.2	14.8	27.2	7.3	173,448,000
		16.9	79.8	44.4		

CAT 3516		
Engine Power	BHP	1412
Generator Output	kW	1000
Operating Hours	hr	8760
efficiency	%	37.5
Energy Input	BTU/BHP-hr	6,927
Energy Input Rate	MMBTU/HR	9.78
Biogas Methane Content	%	60.4%
Biogas LHV	BTU/SCF	550
Biogas Flow Rate	SCFM	296

conversion factors	
grams/lb	454

CAT 3516
THC - Total Hydrocarbons - includes methane
NMHC (VOCs) all non-methane hydrocarbons
NMNEHC (VOCs) all non-methane, non-ethane hydrocarbons
HCHO - Fomaldehyde

Emissions without any pretreatment per engine						
	g/bhp-hr	gram/HR	lbs/hr	lbs/yr	tons/yr	lbs/MMBTU
NOx	1	1412	3.1	27,245	14	0.32
CO	4.77	6735.24	14.8	129,957	65	1.52
Total Hydrocarbons	8.41	11874.92	26.2	229,128	115	2.67
VOC(s) (assumed based on NMHC)	1.26	1779.12	3.9	34,328	17	0.40

Emissions with SCR								
		pre		post				
	g/bhp-hr	%reduction	g/bhp-hr	gram/HR	lbs/hr	lbs/yr	tons/yr	lbs/MMBTU
NOx	0.6	80%	0.12	169.44	0.4	3,269	2	0.04
CO	2.5	90%	0.25	353	0.8	6,811	3	0.08
Total Hydrocarbons	0.43	72%	0.12	169.44	0.4	3,269	2	0.04
VOC(s) (assumed based on NMHC)	0.43	72%	0.12	169.44	0.4	3,269	2	0.04

Total Emissions For 4 units (full power 8760 hrs/yr)					
	lbs/hr	lbs/yr	tons/yr	lbs/MMBTU	lbs/MMSCF
NOx	1.5	13,077	6.5	0.15	21.0
CO	3.1	27,245	13.6	0.32	43.7
Total Hydrocarbons	1.5	13,077	6.5	0.15	21.0
VOC(s)	1.5	13,077	6.5	0.15	21.0

G3516

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

PRELIMINARY

ENGINE SPEED:	1200	FUEL:	SITE SPECIFIC
COMPRESSION RATIO:	11.3:1	FUEL SYSTEM:	DELTEC
AFTERCOOLER - MAX. INLET (°F):	130	WITH CUSTOMER SUPPLIED AIR FUEL RATIO CONTROL	
JACKET WATER - MAX. OUTLET (°F):	230	FUEL PRESS. RANGE (PSIG):	1.5 - 5.0
ASPIRATION:	TA	MIN. METHANE NUMBER:	140
COOLING SYSTEM:	JW, OC+AC	RATED ALTITUDE (FT):	499
IGNITION SYSTEM:	EIS	AT AIR TO TURBO. TEMP. (°F):	109
EXHAUST MANIFOLD:	DRY	NOx EMISSION LEVEL:	1.0 g/bhp-hr
COMBUSTION:	LOW EMISSION	FUEL LHV (BTU/SCF):	526
		APPLICATION:	60 Hz GENSET

RATING AND EFFICIENCY		NOTES	LOAD	100%
ENGINE POWER	(WITHOUT FAN)	(1)	BHP	1412
GENERATOR POWER	(WITHOUT FAN)	(2)	EKW	1000
ENGINE EFFICIENCY	(ISO 3046/1)	(3)	%	37.5
ENGINE EFFICIENCY	(NOMINAL)	(3)	%	36.7
THERMAL EFFICIENCY	(NOMINAL)	(4)	%	36.1
TOTAL EFFICIENCY	(NOMINAL)	(5)	%	72.8

ENGINE DATA				
FUEL CONSUMPTION	(ISO 3046/1)	(6)	BTU/bhp-hr	6795
FUEL CONSUMPTION	(NOMINAL)	(6)	BTU/bhp-hr	6927.0
AIR FLOW (77 °F, 14.7 psi)		(7)	SCFM	2664
AIR FLOW		(7)	lb/hr	11810
COMPRESSOR OUT PRESSURE			in. HG (abs)	84.4
COMPRESSOR OUT TEMPERATURE			°F	327
AFTERCOOLER AIR OUT TEMPERATURE			°F	135
INLET MAN. PRESSURE		(8)	in. HG (abs)	77.6
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(9)	°F	142
TIMING		(10)	°BTDC	24
EXHAUST STACK TEMPERATURE		(11)	°F	932
EXHAUST GAS FLOW (@ stack temp.)		(12)	CFM	7483

EXHAUST MASS FLOW	(12)	lb/hr	13174

EMISSIONS DATA			
NOx (as NO2)	(13)	g/bhp-hr	1
CO	(14)	g/bhp-hr	4.77
THC (molecular weight of 15.84)	(14)	g/bhp-hr	8.41
NMHC (molecular weight of 15.84)	(14)	g/bhp-hr	1.26
EXHAUST O2	(15)	% DRY	6.3
LAMBDA	(15)		1.50

HEAT BALANCE DATA			
LHV INPUT	(16)	BTU/min	163028
HEAT REJECTION TO JACKET (JW)	(17)	BTU/min	24245
HEAT REJECTION TO ATMOSPHERE	(18)	BTU/min	6009
HEAT REJECTION TO LUBE OIL (OC)	(19) (22)	BTU/min	5335
HEAT REJECTION TO EXHAUST (LHV to 77°F)	(20)	BTU/min	55821
HEAT REJECTION TO EXHAUST (LHV to 350°F)	(20)	BTU/min	34627
HEAT REJECTION TO A/C (AC)	(21) (22)	BTU/min	10757
HEAT REJECTION TO ENGINE PUMPS		BTU/min	977.2

Biogas Flares (exempt)

number of flares	1	
SCFM per flare	440	
total SCFM all flares	440	
hours per year	8760	
percent operation	75%	
annual hours of opeartion	6570	
SCF, annual	173,448,000	
% Methane	60.4%	
BTU/SCF	550	
MMBTU/HR (3)	14.52	
lbs-NOX/MMBTU	0.068	EPA AP 42 CHPT 13 sect 13.5, table 13.5-1
total lbs-Nox/hour	0.99	
lbs-Nox/year	6,487	
tons-Nox/year	3.24	
lbs-CO/MMBTU	0.31	EPA AP 42 CHPT 13 sect 13.5, table 13.5-2
lbs-CO/hour	5	
lbs-CO/year	29,573	
tons-CO/year	14.79	
lbs-VOC/MMBTU	0.57	EPA AP 42 CHPT 13 sect 13.5, table 13.5-2
total lbs-VOC/hour	8.28	
lbs-VOC/year	54,376	
tons-VOC/Year	27.19	
lbs-CH4/MMBTU	0.14	slip - EPA AP 42 CHPT 13 sect 13.5, table 13.5-1
total lbs-CH4/hour	2.0	
lbs-CH4/year	13,355	
tons-CH4/Year	6.68	
PPM of H2S in gas	500	
lbs-SO2/hour[1]	2.23	100% 1 mol H2S -> 1 mol SO2
lbs-SO2/year	14,643	
tons-SO2/year	7.32	
lbs-SO2/MMBTU	0.15	

$$\frac{lbs\ SO_2}{hr} = 1575\ \frac{scf}{min} * 60\ \frac{min}{hr} * \frac{500}{10^6} * \frac{1}{379.4}\ \frac{mole\ SO_2}{scf} * 64\ \frac{lb\ SO_2}{mole\ SO_2}$$
$$= 7.98\ \frac{lbs}{hr}$$

$$\frac{lbs\ SO_2}{MMBTU} = \frac{500}{10^6} * \frac{1}{379.4}\ \frac{mole\ SO_2}{scf} * 64\ \frac{lb\ SO_2}{mole\ SO_2} * \frac{10^6\ BTU}{550\ BTU/SCF}$$
$$= 0.15\ \frac{lbs}{MMBTU}$$

Table 13.5-1 (English Units). THC AND SOOT EMISSIONS FACTORS FOR FLARE OPERATIONS[a]

EMISSIONS FACTOR RATING: B

Pollutant	SCC	Emissions Factor Value	Emissions Factor Units
Total hydrocarbons[b]	30190099	0.14	lb/10^6 Btu
Nitrogen oxides[c]	30190099	0.068	lb/10^6 Btu
Soot[c]	30190099	0 - 274	µg/L

[a] Reference 1. Based on tests using crude propylene containing 80% propylene and 20% propane.
[b] Measured as methane equivalent.
[c] Soot in concentration values: nonsmoking flares, 0 micrograms per liter (µg/L); lightly smoking flares, 40 µg/L; average smoking flares, 177 µg/L; and heavily smoking flares, 274 µg/L.

Table 13.5-2 (English Units). VOC and CO EMISSIONS FACTORS FOR FLARE OPERATIONS[a]

Pollutant	SCC	Emissions Factor (lb/10^6 Btu)	Representativeness
Volatile organic compounds[b]	30190099; 30600904	0.57	Poorly
Carbon monoxide[c]	30190099; 30600904	0.31	Poorly

[a] These factors apply to well operated flares achieving at least 98% destruction efficiency and operating in compliance with the current General Provisions requirements of 40 CFR Part 60, i.e. >300 btu/scf net heating value in the vent gas and less than the specified maximum flare tip velocity. These factors are based on steam-assisted and air-assisted flares burning a variety of vent gases.
[b] References 4-9 and 11.
[c] References 1, 4-8 and 11.

Sulfur Dioxide	
SO2	Formula
64.06	Molecular Weight (lb/mol)
315.5	Critical Temp. (°F)
1142	Critical Pressure (psia)
14.3	Boiling Point (°F)
-103.9	Melting Point (°F)
49.3	Psat @ 70°F (psia)
85.98	Liquid Density @ 70°F (lb/ft3)
0.1682	Gas Density @ 70°F 1 atm (lb/ft3)
5.94	Specific Volume @ 70°F 1 atm (ft3/lb)
2.285	Specific Gravity
9.58	Specific Heat @ 70°F (Btu/lbmol-°F)

standard conditions

T	pressure	scf/mol
60 F	14.7	379.4

Max Biogas Production	SCFM	1,000
	SCFH	60,000
	MSCF/Year	526

CAS #		lbs/MMSCF	Fed. HAPs lbs/yr
50-00-0	Formaldehyde	1.31E+00	689.69
71-43-2	Benzene	1.78E-01	93.66
75-09-2	Methane dichloride	1.00E-04	0.05
79-00-5	Ethane, 1,1,2-trichloro	1.00E-04	0.05
79-01-6	Ethene, trichloro-	3.00E-04	0.16
100-41-4	Benzene, ethyl	1.00E-03	0.53
106-46-7	Benzene, p-dichloro-	1.80E-03	0.95
107-06-2	1,2-Ethylene dichloride	1.40E-03	0.74
108-88-3	Toulene	6.48E-02	34.06
108-90-7	Benzene chloride	2.00E-04	0.11
110-54-3	Hexane	6.48E-02	34.06
127-18-4	Ethylene tetrachloride	5.00E-04	0.26
1330-20-7	Benzene, dimethyl	4.50E-03	2.37
7647-01-0	Hydrochloric Acid	6.46E-01	339.27
67-64-1	Acetone	7.00E-04	0.37
	Total Federal HAP Emissions (lbs/yr)		**1,196**

Notes:
1. Emission factors for Federal HAPs from the combustion of biogas in IC engines was taken from San Diego County Air Pollution Control District based on Pt Loma Gas Analysis (8/23/99)
http://www.sdapcd.org/toxics/emissions/combgas/combgas.html
2. Assumes all biogas is combusted at facility through an IC engine (worst

Primary Regulated Emission Sources (combustion of Biogas)

		Constituent			
Device	**Units**	**NOx**	**CO**	**VOC**	
CHP	tons/yr	13.6	65.0	17.2	

Intermittent Sources based on limited operation

		Constituent				
Device	**Units**	**NOx**	**CO**	**VOC**	**SOx**	**SCF/yr**
Biogas Flares	tons/yr	3.2	14.8	27.2	7.3	173,448,000
		16.9	79.8	44.4		

CAT 3516		
Engine Power	BHP	1412
Generator Output	kW	1000
Operating Hours	hr	8760
efficiency	%	37.5
Energy Input	BTU/BHP-hr	6,927
Energy Input Rate	MMBTU/HR	9.78
Biogas Methane Content	%	60.4%
Biogas LHV	BTU/SCF	550
Biogas Flow Rate	SCFM	296

conversion factors	
grams/lb	454

CAT 3516
THC - Total Hydrocarbons - include
NMHC (VOCs) all non-methane hy
NMNEHC (VOCs) all non-methane
HCHO - Fomaldehyde

Emissions without any pretreatment per engine							
	g/bhp-hr	gram/HR	lbs/hr	lbs/yr	tons/yr	lbs/MMBTU	
NOx	1	1412	3.1	27,245	14	0.32	
CO	4.77	6735.24	14.8	129,957	65	1.52	
Total Hydrocarbons	8.41	11874.92	26.2	229,128	115	2.67	
VOC(s)	1.26	1779.12	3.9	34,328	17	0.40	assumed based on NMHC

Emissions with SCR								
		pre		post				
	g/bhp-hr	%reduction	g/bhp-hr	gram/HR	lbs/hr	lbs/yr	tons/yr	lbs/MMBTU
NOx	0.6	80%	0.12	169.44	0.4	3,269	2	0.04
CO	2.5	90%	0.25	353	0.8	6,811	3	0.08
Total Hydrocarbons	0.43	72%	0.12	169.44	0.4	3,269	2	0.04
VOC(s)	0.43	72%	0.12	169.44	0.4	3,269	2	0.04

assumed based on NMHC

Total Emissions For 4 units (full power 8760 hrs/yr)					
	lbs/hr	lbs/yr	tons/yr	lbs/MMBTU	lbs/MMSCF
NOx	1.5	13,077	6.5	0.15	21.0
CO	3.1	27,245	13.6	0.32	43.7
Total Hydrocarbons	1.5	13,077	6.5	0.15	21.0
VOC(s)	1.5	13,077	6.5	0.15	21.0

NOx

8760 hours x 1 g/bhp-hr x 1412 bHp x 0.0022 lb/g / 2000 lb/TN = 13.61 TPY
1 g/bhp-hr x 1412 bHp x 0.0022 lb/g / = 3.1064 lb/hr

CO

8760 hours x 4.77 g/bhp-hr x 1412 bHp x 0.0022 lb/g / 2000 lb/TN = 64.90 TPY
4.77 g/bhp-hr x 1412 bHp x 0.0022 lb/g / = 14.817528 lb/hr

NMHC

8760 hours x 1.26 g/bhp-hr x 1412 bHp x 0.0022 lb/g / 2000 lb/TN = 17.14 TPY
1.26 g/bhp-hr x 1412 bHp x 0.0022 lb/g / = 3.914064 lb/hr

PM10

154 MMCF x 0.006 lb/Mmbtu x 526 btu/CF x 2000 lb/TN = 0.24 TPY

SO2

8760 hours x 0.58 lbs/hr x 2000 lb/TN = 2.54 TPY

Formaldehyde

8760 hours x 0.25 g/bhp-hr x 1412 bHp x 0.0022 lb/g / 2000 lb/TN = 3.40 TPY
0.25 g/bhp-hr x 1412 bHp x 0.0022 lb/g / = 0.7766 lb/hr

Total = 123.67 TPY

NOTE: PM, NMHC and SOX are manufacturer's numbers.
NOx and CO provided by Ohio EPA Central Office
Formaldehyde is from manufacture's specifications for Jenbacher

** = SO2 emissions calculated as follows
max. H2S content of gas = 1000 ppm at 9.78 MMBtu/hr and 550 Btu / cf

9780000 BTU/hr @ 550 Btu/cf = 17,781.82 cf / hr fuel consumption 17781.81818

17,781.82 cf / hr @ 500 ppm H2S = 17,781.82 cf / hr * (500 / 1000000) * (0.088 lb H2S / cf H2S) = 1.56 lb H2S / hr 0.78240008

0.542 lb H2S / hr * 1.88 lb SO2 / lb H2S = 1.47091215 lb SO2 / hr
0.150400015

for 500 ppm H2S content max = 2.545 lb SO2/hr

es methane
drocarbons
, non-ethane hydrocarbons

G3516 GAS ENGINE TECHNICAL DATA

CATERPILLAR®

PRELIMINARY

ENGINE SPEED:	1200	FUEL:	SITE SPECIFIC
COMPRESSION RATIO:	11.3:1	FUEL SYSTEM:	DELTEC
AFTERCOOLER - MAX. INLET (°F):	130	WITH CUSTOMER SUPPLIED AIR FUEL RATIO CONTROL	
JACKET WATER - MAX. OUTLET (°F):	230	FUEL PRESS. RANGE (PSIG):	1.5 - 5.0
ASPIRATION:	TA	MIN. METHANE NUMBER:	140
COOLING SYSTEM:	JW, OC+AC	RATED ALTITUDE (FT):	499
IGNITION SYSTEM:	EIS	AT AIR TO TURBO. TEMP. (°F):	109
EXHAUST MANIFOLD:	DRY	NOx EMISSION LEVEL:	1.0 g/bhp-hr
COMBUSTION:	LOW EMISSION	FUEL LHV (BTU/SCF):	526
		APPLICATION:	60 Hz GENSET

RATING AND EFFICIENCY		NOTES	LOAD	100%
ENGINE POWER	(WITHOUT FAN)	(1)	BHP	1412
GENERATOR POWER	(WITHOUT FAN)	(2)	EKW	1060
ENGINE EFFICIENCY	(ISO 3046/1)	(3)	%	37.5
ENGINE EFFICIENCY	(NOMINAL)	(3)	%	36.7
THERMAL EFFICIENCY	(NOMINAL)	(4)	%	36.1
TOTAL EFFICIENCY	(NOMINAL)	(5)	%	72.8

ENGINE DATA				
FUEL CONSUMPTION	(ISO 3046/1)	(6)	BTU/bhp-hr	6795
FUEL CONSUMPTION	(NOMINAL)	(6)	BTU/bhp-hr	6927.0
AIR FLOW (77 °F, 14.7 psi)		(7)	SCFM	2664
AIR FLOW		(7)	lb/hr	11818
COMPRESSOR OUT PRESSURE			in. HG (abs)	84.4
COMPRESSOR OUT TEMPERATURE			°F	327
AFTERCOOLER AIR OUT TEMPERATURE			°F	135
INLET MAN. PRESSURE		(8)	in. HG (abs)	77.6
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(9)	°F	142
TIMING		(10)	°BTDC	24
EXHAUST STACK TEMPERATURE		(11)	°F	932
EXHAUST GAS FLOW (@ stack temp.)		(12)	CFM	7483
EXHAUST MASS FLOW		(12)	lb/hr	13174

EMISSIONS DATA			
NOx (as NO2)	(13)	g/bhp-hr	1
CO	(14)	g/bhp-hr	4.77
THC (molecular weight of 15.84)	(14)	g/bhp-hr	8.41
NMHC (molecular weight of 15.84)	(14)	g/bhp-hr	1.26
EXHAUST O2	(15)	% DRY	6.3
LAMBDA	(15)		1.58

HEAT BALANCE DATA			
LHV INPUT	(16)	BTU/min	163028
HEAT REJECTION TO JACKET (JW)	(17)	BTU/min	24245
HEAT REJECTION TO ATMOSPHERE	(18)	BTU/min	8099
HEAT REJECTION TO LUBE OIL (OC)	(19) (22)	BTU/min	5335
HEAT REJECTION TO EXHAUST (LHV to 77°F)	(20)	BTU/min	55621
HEAT REJECTION TO EXHAUST (LHV to 350°F)	(20)	BTU/min	34627
HEAT REJECTION TO A/C (AC)	(21) (22)	BTU/min	10757
HEAT REJECTION TO ENGINE PUMPS		BTU/min	977.2

Biogas Flares (exempt)

number of flares	1		
SCFM per flare	440		
total SCFM all flares	440		
hours per year	8760		
percent operation	75%		
annual hours of opeartion	6570		
SCF, annual	173,448,000		
% Methane	60.4%		
BTU/SCF	550		
MMBTU/HR (3)	14.52		
lbs-NOX/MMBTU	0.068		EPA AP 42 CHPT 13 sect 13.5, table 13.5-1
total lbs-Nox/hour	0.99		
lbs-Nox/year	6,487		
tons-Nox/year	3.24		
lbs-CO/MMBTU	0.31		EPA AP 42 CHPT 13 sect 13.5, table 13.5-2
lbs-CO/hour	5		
lbs-CO/year	29,573		
tons-CO/year	14.79		
lbs-VOC/MMBTU	0.57		EPA AP 42 CHPT 13 sect 13.5, table 13.5-2
total lbs-VOC/hour	8.28		
lbs-VOC/year	54,376		
tons-VOC/Year	27.19		
lbs-CH4/MMBTU	0.14	slip	EPA AP 42 CHPT 13 sect 13.5, table 13.5-1
total lbs-CH4/hour	2.0		
lbs-CH4/year	13,355		
tons-CH4/Year	6.68		
PPM of H2S in gas	500		
lbs-SO2/hour[1]	2.23		100% 1 mol H2S -> 1 mol SO2
lbs-SO2/year	14,643		
tons-SO2/year	7.32		
lbs-SO2/MMBTU	0.15		

$$\frac{lbs\ SO_2}{hr} = 1575\ \frac{scf}{min} * 60\ \frac{min}{hr} * \frac{500}{10^6} * \frac{1}{379.4}\ \frac{mole\ SO_2}{scf} * 64\ \frac{lb\ SO_2}{mole\ SO_2}$$
$$= 7.98\ \frac{lbs}{hr}$$

$$\frac{lbs\ SO_2}{MMBTU} = \frac{500}{10^6} * \frac{1}{379.4}\ \frac{mole\ SO_2}{scf} * 64\ \frac{lb\ SO_2}{mole\ SO_2} * \frac{10^6\ BTU}{550\ BTU/SCF}$$
$$= 0.15\ \frac{lbs}{MMBTU}$$

Table 13.5-1 (English Units). THC AND SOOT EMISSIONS FACTORS FOR FLARE OPERATIONS[a]

EMISSIONS FACTOR RATING: B

Pollutant	SCC	Emissions Factor Value	Emissions Factor Units
Total hydrocarbons[b]	30190099	0.14	lb/10^6 Btu
Nitrogen oxides[c]	30190099	0.068	lb/10^6 Btu
Soot[c]	30190099	0 - 274	µg/L

[a] Reference 1. Based on tests using crude propylene containing 80% propylene and 20% propane.
[b] Measured as methane equivalent.
[c] Soot in concentration values: nonsmoking flares, 0 micrograms per liter (µg/L); lightly smoking flares, 40 µg/L; average smoking flares, 177 µg/L; and heavily smoking flares, 274 µg/L.

Table 13.5-2 (English Units). VOC and CO EMISSIONS FACTORS FOR FLARE OPERATIONS[a]

Pollutant	SCC	Emissions Factor (lb/10^6 Btu)	Representativeness
Volatile organic compounds[b]	30190099; 30600904	0.57	Poorly
Carbon monoxide[c]	30190099; 30600904	0.31	Poorly

[a] These factors apply to well operated flares achieving at least 98% destruction efficiency and operating in compliance with the current General Provisions requirements of 40 CFR Part 60, i.e. >300 btu/scf net heating value in the vent gas and less than the specified maximum flare tip velocity. These factors are based on steam-assisted and air-assisted flares burning a variety of vent gases.
[b] References 4-9 and 11.
[c] References 1, 4-8 and 11.

Sulfur Dioxide	
SO2	Formula
64.06	Molecular Weight (lb/mol)
315.5	Critical Temp. (°F)
1142	Critical Pressure (psia)
14.3	Boiling Point (°F)
-103.9	Melting Point (°F)
49.3	Psat @ 70°F (psia)
85.98	Liquid Density @ 70°F (lb/ft3)
0.1682	Gas Density @ 70°F 1 atm (lb/ft3)
5.94	Specific Volume @ 70°F 1 atm (ft3/lb)
2.285	Specific Gravity
9.58	Specific Heat @ 70°F (Btu/lbmol-°F)

standard conditions

T	pressure	scf/mol
60 F	14.7	379.4

Max Biogas Production	SCFM	1,000
	SCFH	60,000
	MSCF/Year	526

CAS #		lbs/MMSCF	Fed. HAPs lbs/yr
50-00-0	Formaldehyde	1.31E+00	689.69
71-43-2	Benzene	1.78E-01	93.66
75-09-2	Methane dichloride	1.00E-04	0.05
79-00-5	Ethane, 1,1,2-trichloro	1.00E-04	0.05
79-01-6	Ethene, trichloro-	3.00E-04	0.16
100-41-4	Benzene, ethyl	1.00E-03	0.53
106-46-7	Benzene, p-dichloro-	1.80E-03	0.95
107-06-2	1,2-Ethylene dichloride	1.40E-03	0.74
108-88-3	Toulene	6.48E-02	34.06
108-90-7	Benzene chloride	2.00E-04	0.11
110-54-3	Hexane	6.48E-02	34.06
127-18-4	Ethylene tetrachloride	5.00E-04	0.26
1330-20-7	Benzene, dimethyl	4.50E-03	2.37
7647-01-0	Hydrochloric Acid	6.46E-01	339.27
67-64-1	Acetone	7.00E-04	0.37
	Total Federal HAP Emissions (lbs/yr)		**1,196**

Notes:
1. Emission factors for Federal HAPs from the combustion of biogas in IC engines was taken from San Diego County Air Pollution Control District based on Pt Loma Gas Analysis (8/23/99)
http://www.sdapcd.org/toxics/emissions/combgas/combgas.html
2. Assumes all biogas is combusted at facility through an IC engine (worst